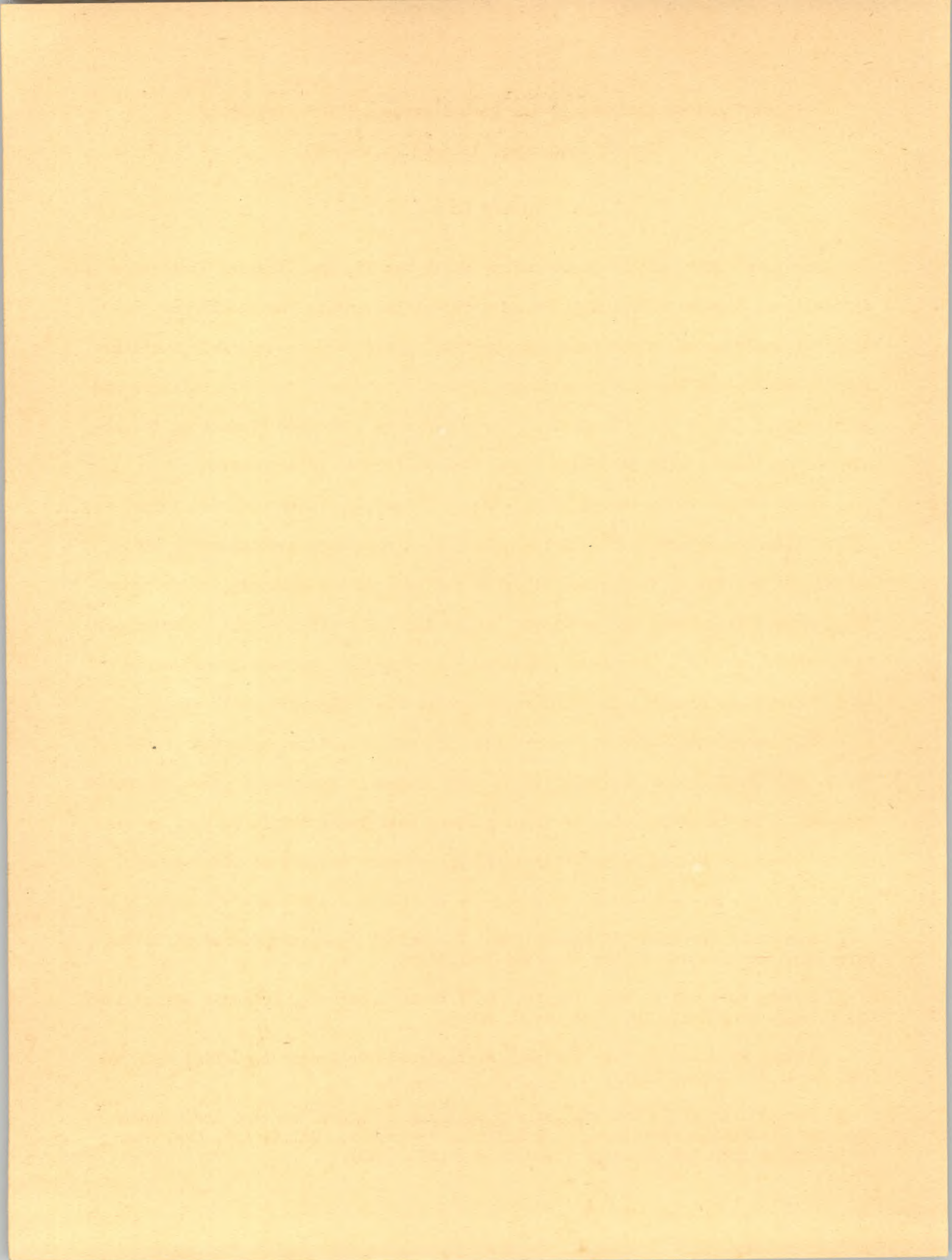University of California
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STATISTICAL ANALYSIS OF THE ANNUAL AVERAGE F.O.B. PRICES

OF CANNED ASPARAGUS, 1925-26 TO 1948-49

by

Sidney Hoos

Statistical Analysis of the Annual Average F.O.B. Prices of

Canned Asparagus, 1925-26 to 1948-49

Sidney Hoos[1]

During a number of the years before World War II, the Giannini Foundation of Agricultural Economics annually issued a report presenting the results of statistical analyses of canned asparagus prices. Those reports were made available for the benefit of the canned asparagus industry, growers, packers, shippers and purchasers. During the war years, the reports were suspended because of the abnormal conditions which prevailed then, such as federal price control.

In September 1947, the California Agricultural Experiment Station issued two publications on asparagus.[2] Those publications were made available for the purpose of presenting in general terms an analysis of the economic trends underlying canned asparagus, and providing background information on the industry and its economic status. The prewar, wartime, and immediate postwar developments were reviewed to give a comprehensive basis for the industry's outlook.

This report undertakes to resume the type of statistical analyses of the F.O.B. prices of canned asparagus which were issued in the prewar years, as noted above.[3] With the experience of three postwar pack-years available now, we are beginning to get the basis for determining the postwar pattern of statistical

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[1] Associate Professor of Agricultural Economics, Associate Economist in the Experiment Station and on the Giannini Foundation.

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[3] For additional recent statistical data see: Sidney Hoos and Irvin Dubov. Selected Statistics Pertaining to California Asparagus. Calif. Agr. Exp. Sta. Contribution from the Giannini Foundation (April 1949).

Statistical Analysis of the Annual Average F.O.B. Prices of

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relations. Analysis of the available evidence indicates the existence of a pattern which bears some similarity to but also has some characteristics different from the prewar statistical relations. A major difference concerns the effects of consumers' money income as reflected by the index of nonagricultural income payments. In the prewar years, the net relation between the prices and consumers' income was best measured by a straight-line; that is, a change of income from one level had the same effect on price as a change of income from another level, within the range of experience. But when the postwar years are included in the analysis, it appears that the net relation between the prices and consumers' income can be adequately reflected by a curve; that is, the effect which a change of income has on price is influenced by the income level from which the change is considered. In other terms, an increase of 10 points in the income index, if money income is high as in postwar years, is associated with a smaller increase in the price than if the income index increases 10 points in relatively low income years such as the middle 1930's.

Below we present the results of an analysis of the major factors which have influenced the annual average F.O.B. prices received for canned asparagus by canners in California from 1925-26 through 1948-49, but excluding the war years 1941-42 through 1945-46. The war years were omitted from the analysis because of the reasons noted above.

Three formulations of the statistical demand relations for canned asparagus are summarized in this report. All three formulations cover the period 1925-26 through 1948-49, excluding the war years 1941-42 through 1945-46.

The first formulation concerns the average relationships between F.O.B. prices of California canned asparagus and (1) domestic shipments of California canned asparagus, (2) the index of nonagricultural income payments in the United States, and (3) factors included under "time." For this first formulation:

Equation 1 in table 2 summarizes the statistical results obtained when the F.O.B. price is considered as the dependent variable and the other three variables are used as the independent ones;

Equation 2 in table 2 summarizes the statistical results when the volume of domestic shipments of California canned asparagus is considered as the dependent variable and is related to the F.O.B. price, index of nonagricultural income, and the time-trend of demand.

The second formulation is similar to the first, except that income is expressed in terms of its logarithms which is a convenient procedure for measuring the relations of relative changes in the income index. Also, the "time" variable is reflected in a modified manner. For the second formulation:

Equation 3 in table 2 summarizes the statistical results when the F.O.B. price is considered as the dependent variable; and equation 4 in table 2 summarizes the results when domestic shipments of California canned asparagus is considered as the dependent variable.

In the two formulations noted above, "time" is used as a proxy for and is presumed to reflect the combined influence of factors which change smoothly and persistently with time. It appears that a very important factor of that type is the volume of asparagus canned in states other than California.

The third formulation concerns the average relations between the F.O.B. prices of California canned asparagus and (1) domestic shipments of California canned asparagus, (2) the logarithm of the index of nonagricultural income payments in the United States, and (3) the volume of asparagus canned in states other than California. For the third formulation:

3.

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Equation 5 in table 2 summarizes the statistical results when the F.O.B. price is considered as the dependent variable; and equation 6 in table 2 summarizes the results when domestic shipments of California canned asparagus is considered as the dependent variable.

When the F.O.B. prices are viewed as the dependent variable, the results of all three formulations (equations 1, 3 and 5 in table 2) are about equally acceptable on statistical grounds; the third formulation (equation 3) is very slightly better than the other two, but not significantly better. When the domestic shipments of California canned asparagus are considered as the dependent variable, the first formulation (equation 2) is less acceptable than the other two; but the third formulation (equation 6) is only very slightly better (not significantly so) than the second formulation (equation 4). From the combined viewpoints of economics, marketing and statistics, the third formulation appears to be the most acceptable. Hence, that formulation is further considered, with F.O.B. price viewed as the dependent variable.

The average relationships which prevailed from 1925-26 through 1948-49 (excluding 1941-42 through 1945-46) between the F.O.B. prices of California canned asparagus and three major factors were measured. The three price-influencing factors include (1) domestic shipments of California canned asparagus, (2) nonagricultural income payments in the United States, and (3) volume of asparagus canned outside of California.

Figure 1 shows graphically the average relations between the F.O.B. price and each of the independent variables, as determined by equation 5 in table 2. Expressed in numerical terms, these average relations are as follows for the period of years under consideration:

(a) With both the nonagricultural income payments and the volume of asparagus canned outside of California held constant, a change

4.

Equation 6 in table 2 summarizes the statistical results
when the F.O.B. price is considered as the dependent variable;
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shipments of California canned asparagus is considered as the
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and each of the independent variables, as determined by equation 5 in table 2.
Expressed in numerical terms, these average relations are as follows for the
period of years under consideration:

(a) With both the nonagricultural income payments and the volume of
asparagus canned outside of California held constant, a change

of 100,000 cases in domestic shipments of California canned asparagus was on the average accompanied by a change in the opposite direction of 13 cents a case in the F.O.B. price of California canned asparagus. This relation is shown graphically in panel A of figure 1.
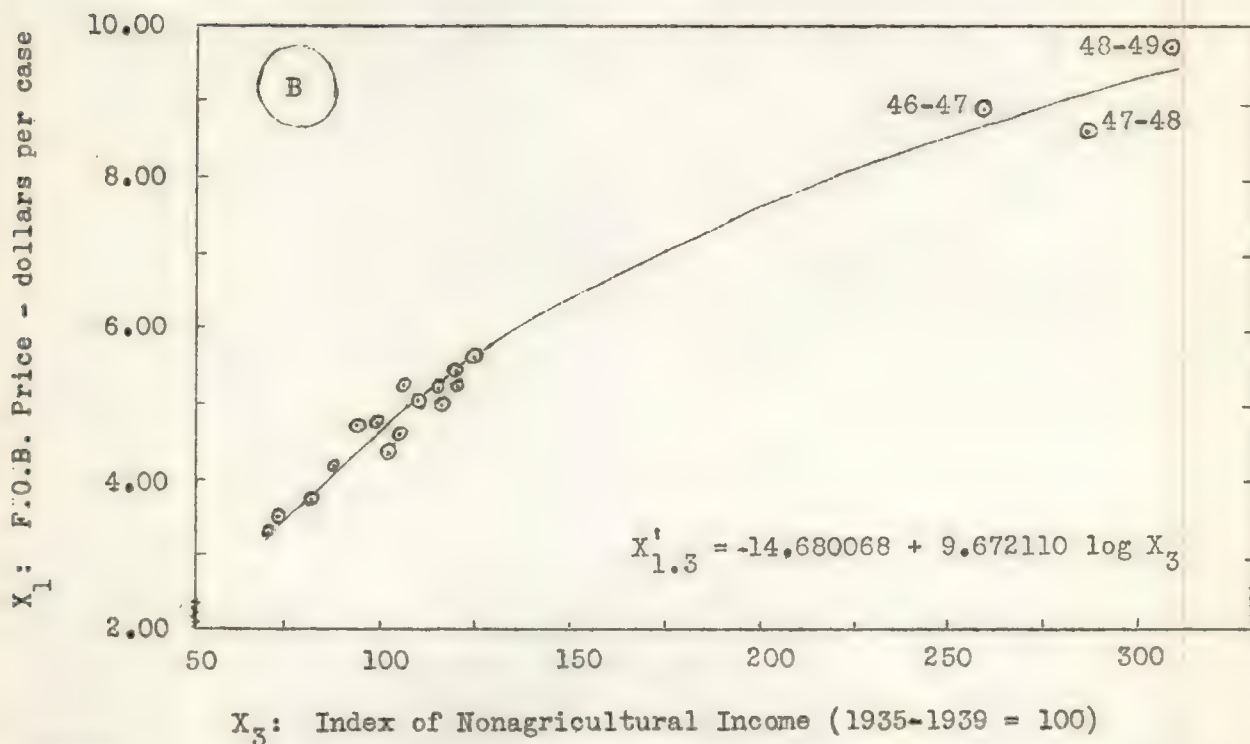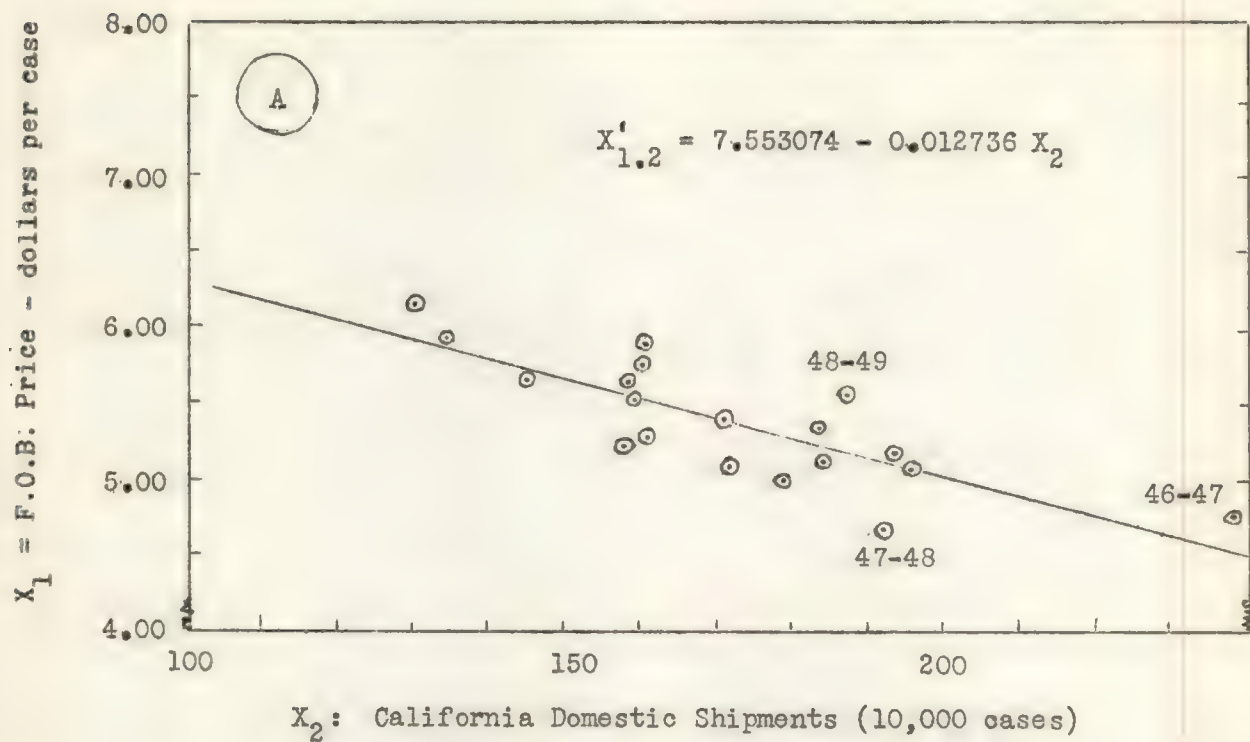
(b) With both domestic shipments of California canned asparagus and the volume of outside pack held constant, a change of 10 per cent in the index of nonagricultural income payments was on the average accompanied by a change in the same direction of 40 cents a case in the F.O.B. price of California canned asparagus. This relation is shown graphically in panel B of figure 1.

(c) With both domestic shipments of California canned asparagus and nonagricultural income payments held constant, a change of 100,000 cases in the volume of asparagus canned outside of California was on the average accompanied by a change in the opposite direction of 10 cents a case in the F.O.B. price of California canned asparagus. This relation is shown graphically in panel C of figure 1.

Differences between the actual prices and those estimated by equation 5 are given in table 3, column 3. The differences are plotted as deviations from the respective net regression lines in figure 1.

Figure 1: Net Regression of F.O.B. Prices of California Canned Asparagus, 1925-26 to 1948-49, on: A, Domestic Shipments of California Canned Asparagus; B, Index of Nonagricultural Income Payments; and C, Pack of Asparagus Canned Outside of California

$$X'_{1.2} = 7.553074 - 0.012736\ X_2$$

48-49

47-48

46-47

X_1 = F.O.B. Price - dollars per case

X_2: California Domestic Shipments (10,000 cases)

48-49

46-47

47-48

$$X'_{1.3} = -14.680068 + 9.672110\ \log X_3$$

X_1: F.O.B. Price - dollars per case

X_3: Index of Nonagricultural Income (1935-1939 = 100)

Figure 1 continued.

$$X'_{1.4} = 5.868055 - 0.000998 \, X_4$$

X-axis: X_4: Pack of other states (1,000 cases)

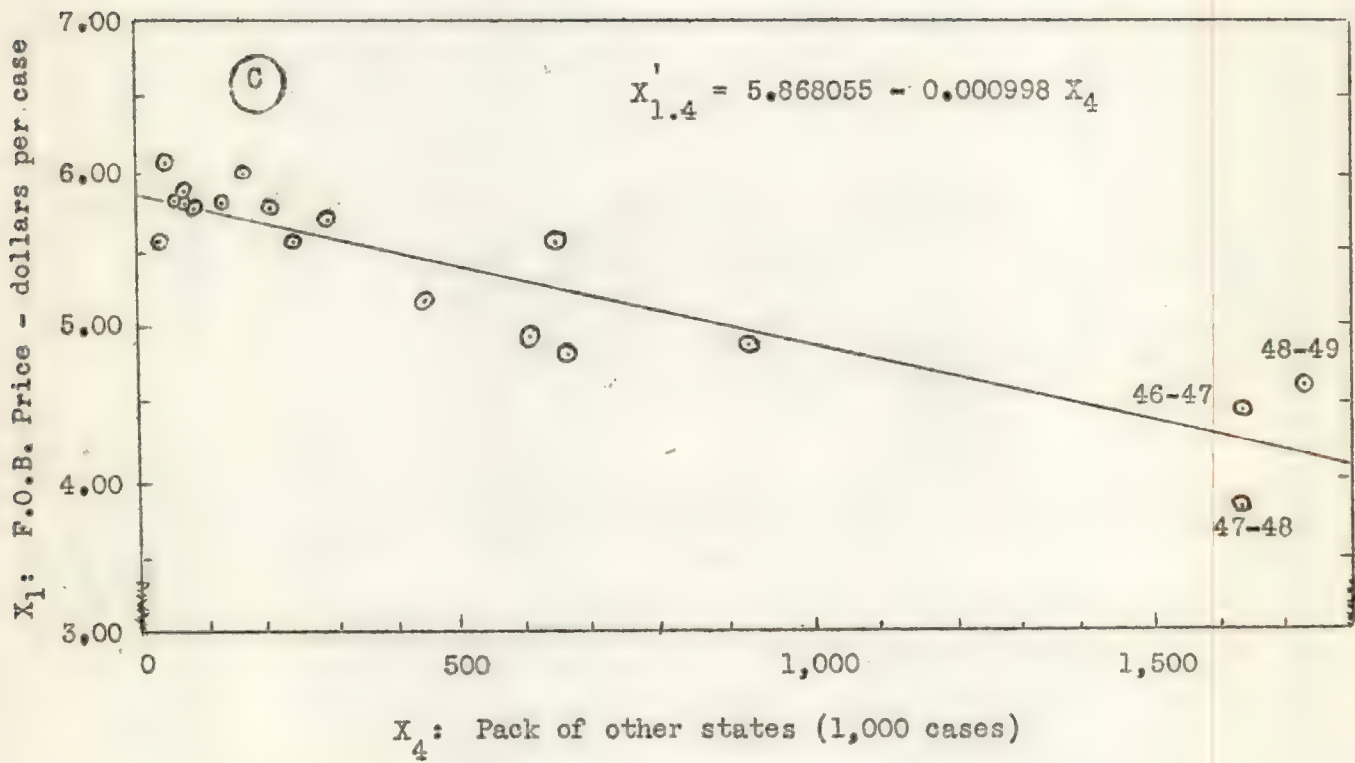Y-axis: X_1: F.O.B. Price – dollars per case

TABLE 1

Annual Average F.O.B. Prices of California Canned Asparagus
and Important Factors Affecting Them, 1925-26 to 1948-49

Year March through February	F.O.B. price of California canned asparagus	Domestic shipments of California canned asparagus	Index of non-agricultural income (1935-39=100)	Canned asparagus pack of states other than California
	1	2	3	4
	dollars per case	10,000 cases	per cent	1,000 cases
1925-26	6.01	134	110	48
1926-27	5.69	171	114	37a/
1927-28	5.44	172	115	26
1928-29	5.63	193	119	40a/
1929-30	5.69	195	123	53
1930-31	5.64	159	110	100a/
1931-32	5.54	130	94	142
1932-33	4.10	159	72	20
1933-34	3.49	183	71	184
1934-35	4.30	145	80	235
1935-36	4.55	158	87	281
1936-37	4.75	160	103	438
1937-38	5.22	159	106	631
1938-39	4.48	158	101	607
1939-40	4.44	179	108	671
1940-41	4.68	184	117	927
1941-42	5.52	156	143	1,449
1942-43	(n.a.)	229	183	1,657
1943-44	(n.a.)	209	221	1,483
1944-45	(n.a.)	244	242	1,396
1945-46	6.38	246	247	1,440
1946-47	6.86	238	258	1,659
1947-48	7.21	192	285	1,658
1948-49a/	8.32	187	307	1,715

a/ Preliminary, subject to revision; (n.a.), not available.

Sources of data:
 Col. 1: Years 1925-26 to 1935-36 compiled from records of canners. Years
          1936-37 to 1948-49 from reports of Asparagus Advisory Board and
          records of canners.
 Col. 2: From table 4, col. 6.
 Col. 3: All figures obtained from the following sources, converted to 1935-1939
          base by dividing by 62.22. 1925-26 to 1928-29; U.S.B.A.E. mimeo. dated
          2/2/42. 1929-30 and all subsequent years; National Supplement to Survey
          of Current Business, July 1947, table 48; Survey of Current Business,
          Jan. 1949 and weekly supplements--Feb. 11 and March 11, 1949.
 Col. 4: Years 1925-26 to 1932-33 from U.S. Dept. of Commerce, Biennial Census of
          Manufactures, with 1926-27, 1928-29, and 1930-31 estimated; years 1933-
          34 to 1941-42 compiled from Canned Food Pack Statistics, National
          Canners Association; years 1942-43 to 1948-49 derived from data in
          Canners League of California, Special Bulletin, December 28, 1948,
          San Francisco.

TABLE 2

California Canned Asparagus
Regression Coefficients and Auxiliary Constants for Multiple Regression Analyses
Covering 1925-26 through 1948-49 (excluding 1941-42 through 1945-46)

Equation	Dependent variable	Constant term	Net regression coefficients[a] (figures in parentheses are t-ratios)							Adjusted co-efficient of multiple cor-relation: $\bar{R}$
			X_1	X_2	X_3	$\log 10(X_3)$	X_4	t	t^2	
1	2	3	4	5	6	7	8	9	10	11
1	X_1	3.558254		-0.011268 (3.395960)	0.031402 (6.411849)			-0.118420 (5.103034)	-0.008271 (1.765824)	0.9728
2	X_2	208.808293	-40.084387 (3.395960)		1.533069 (3.740093)			-5.259179 (2.809868)	-0.508232 (1.831976)	0.7628
3	X_1	-10.023225		-0.012622 (4.187852)		8.463105 (17.430529)		-0.059260 (5.187517)		0.9773
4	X_2	-418.909099	-42.704453 (4.187852)			395.139516 (4.884515)		-2.308664 (2.463400)		0.8173
5	X_1	-11.999990		-0.012736 (4.377667)		9.672110 (15.763148)	-0.000998 (5.464351)			0.9788
6	X_2	-514.393086	-44.043169 (4.377667)			454.694132 (4.770193)	-0.040718 (2.658475)			0.8265

[a] X_1 = Annual average f.o.b. price of California canned asparagus; in dollars per case (see table 1, col. 1).

X_2 = Domestic shipments of California canned asparagus; in units of 10,000 cases (see table 1, col. 2).

X_3 = Index of nonagricultural income payments in the United States, 1935-39=100 (see table 1, col. 3).

X_4 = Canned asparagus pack of states other than California; in units of 1,000 cases (see table 1, col. 4).

t = Time in years; origin at 1935-36.

9.

TABLE 3

Actual and Estimated F.O.B. Prices of
California Canned Asparagus, 1925-26 through 1948-49
(excluding 1941-42 through 1946-46)

Year March through February	Actual price	Estimated price	Difference: col. 1 minus col. 2	Percentage difference; col. 3 as per cent of col. 1
	1	2	3	4
	dollars per case			per cent
1925-26	6.01	5.99	0.02	0.33
1926-27	5.69	5.68	0.01	0.18
1927-28	5.44	5.71	-0.27	-4.96
1928-29	5.63	5.58	0.05	0.89
1929-30	5.69	5.68	0.01	0.18
1930-31	5.64	5.62	0.02	0.35
1931-32	5.54	5.29	0.25	4.51
1932-33	4.10	3.92	0.18	4.39
1933-34	3.49	3.39	0.10	2.87
1934-35	4.30	4.33	-0.03	-0.70
1935-36	4.55	4.47	0.08	1.76
1936-37	4.75	4.99	-0.24	-5.05
1937-38	5.22	4.93	0.29	5.56
1938-39	4.48	4.77	-0.29	-6.47
1939-40	4.44	4.72	-0.28	-6.31
1940-41	4.68	4.74	-0.06	-1.28
:				
(war years)				
:				
1946-47	6.86	6.64	0.22	3.21
1947-48	7.21	7.64	-0.43	-5.96
1948-49	8.32	7.96	0.36	4.33

Sources of data:
    Col. 1: From table 1, col. 1.
    Col. 2: Based on equation 5, table 2.

TABLE 5

Actual and Estimated F.O.B. Prices of
California Canned Asparagus, 1925-26 through 1948-49
(excluding 1941-42 through 1945-46)

Year March through February	Actual price 1	Estimated price 2	Difference: col. 1 minus col. 2 3	Percentage differences: col. 3 as per cent of col. 1 4
	dollars per case			per cent
1925-26	6.01	5.99	0.02	0.35
1926-27	5.69	5.68	0.01	0.14
1927-28	5.44	5.71	-0.27	-4.96
1928-29	5.63	5.60	0.03	0.56
1929-30	5.89	5.89	0.01	0.18
1930-31	5.64	5.62	0.02	0.35
1931-32	5.04	5.29	-0.23	-4.51
1932-33	4.10	3.96	0.14	3.39
1933-34	3.49	3.39	0.10	2.87
1934-35	4.30	4.32	-0.02	-0.70
1935-36	4.55	4.47	0.08	1.76
1936-37	4.79	5.03	-0.24	-5.08
1937-38	5.28	5.28	0.25	5.08
1938-39	4.49	4.77	-0.28	-6.47
1939-40	4.44	4.72	-0.28	-6.31
1940-41	4.68	4.76	-0.08	-1.68
1941-42 through 1945-46 (war years)				
1946-47	6.86	6.64	0.22	3.21
1947-48	7.21	7.64	-0.43	-6.96
1948-49	8.32	7.96	0.36	4.33

Sources of data:
Col. 1: From table 1, col. 1.
Col. 2: Based on equation 5, table 2.

TABLE 4

Pack, Carry-over, Shipments and Domestic Movement
of California Canned Asparagus,
1925-26 to 1948-49

Year March through February	California				United States exports	California domestic shipments
	Pack	Carry-over from preceding year	Available for shipment	Total shipments		
	1	2	3	4	5	6
	in 1,000 cases					
1925-26	1,745	170	1,915	1,664	325	1,339
1926-27	2,236	251	2,487	2,080	367	1,713
1927-28	2,190	407	2,597	2,195	474	1,721
1928-29	2,338	402	2,740	2,471	540	1,931
1929-30	2,673	269	2,942	2,619	671	1,948
1930-31	2,663	323	2,986	2,028	435	1,593
1931-32	1,747	958	2,705	1,646	350	1,296
1932-33	1,313	1,059	2,372	1,918	326	1,592
1933-34	2,135	454	2,589	2,313	485	1,828
1934-35	1,914	276	2,190	1,980	533	1,447
1935-36	2,238	210	2,448	2,143	568	1,575
1936-37	2,350	305	2,655	2,133	530	1,603
1937-38	2,072	522	2,594	2,018	431	1,587
1938-39	1,796	576	2,372	1,922	340	1,582
1939-40	1,849	450	2,299	2,126	338	1,788
1940-41	2,182	173	2,355	1,956	116	1,840
1941-42	1,578	399	1,977	1,670	115	1,555
1942-43	2,258	307	2,565	2,345	51	2,294
1943-44	2,071	220	2,291	2,114	20	2,094
1944-45	2,436	177	2,614	2,462	20	2,442
1945-46	2,480	152	2,632	2,506	47	2,459
1946-47	2,783	126	2,909	2,720	344	2,376
1947-48	2,259	189	2,448	2,274	352	1,922
1948-49a/	1,983	174	2,157	2,027	156b/	1,871
1949-50a/		130				

a/ Preliminary, subject to revision.

b/ March through December 1948.

Sources of data:
    Cols. 1-4; Canners League of California and Asparagus Advisory Boards. Carry-
        over figures are total stocks on hand, sold and unsold.
    Col. 5;   Compiled from reports of United States Bureau of Foreign and
        Commerce. Pounds converted to cases on the basis of 34 pounds
        per case.
    Col. 6;   Col. 4 minus col. 5.

TABLE 4

Pack, Carry-over, Shipments and Domestic Movement
of California Canned Asparagus,
1925-26 to 1948-49

Year March through February	Pack	Carry-over from preceding year	California			
			Total shipments	Available for shipment	United States exports	California Domestic shipments
1	2	3	4	5	6
			In 1000 cases			
1925-26	1,745	—	1,915	1,994	355	1,389
1926-27	2,236	281	2,497	2,080	507	1,713
1927-28	2,180	407	2,597	2,195	474	1,721
1928-29	2,338	402	2,740	2,471	540	1,931
1929-30	2,675	269	2,943	2,919	571	1,948
1930-31	2,563	323	2,986	2,028	436	1,592
1931-32	1,747	958	2,705	1,648	360	1,288
1932-33	1,815	1,059	2,873	1,918	320	1,562
1933-34	2,159	454	2,693	2,313	435	1,828
1934-35	1,914	376	2,190	1,980	533	1,447
1935-36	2,238	210	2,448	2,143	568	1,575
1936-37	2,350	306	2,656	2,133	530	1,603
1937-38	2,072	522	2,594	2,018	431	1,587
1938-39	1,796	576	2,372	1,932	340	1,592
1939-40	1,849	440	2,289	2,128	338	1,790
1940-41	2,183	173	2,356	1,956	116	1,840
1941-42	1,578	399	1,977	1,870	115	1,755
1942-43	2,259	304	2,563	2,346	81	2,264
1943-44	2,071	220	2,291	2,114	20	2,094
1944-45	2,436	177	2,614	2,486	20	2,442
1945-46	2,460	182	2,652	2,608	42	2,465
1946-47	2,763	126	2,903	2,750	364	2,379
1947-48	2,296	180	2,448	2,274	242	2,032
1948-49a/	1,983	174	2,157	2,027	156b/	1,871
1949-50a/		150				

a/ Preliminary, subject to revision.

b/ March through December 1948.

Sources of data:

Cols. 1-4: Canners League of California and Asparagus Advisory Boards. Carry-over figures are total stocks on hand; sold and unsold.

Col. 5: Compiled from reports of United States Bureau of Foreign and Domestic Commerce. Pounds converted to cases on the basis of 24 pounds per case.

Col. 6: Col. 4 minus col. 5.